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MINERAL EXPLORATION POTENTIAL OF ERTS-1 DATA

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16. Abstract <p>Further analysis of ERTS MSS imagery of Arizona has led to division of the earlier reported three major regional fault/fracture systems into eight subdivisions. These are as follows: System "A" N40E to N50E; System "B" N50W; System "C" N35W; System "D" N65E to N75E; System "E" N-E; System "F" N25W average; System "G" N75W average; and System "H" close to E-W. Their individual significance to known porphyry coppers and correlation to the Wasatch-Jerome and Front Orogens, the Texas Zone and Basin Range topography is postulated in the report.</p> <p>In this study area of Arizona the ERTS-mapped structural trends confirm and greatly extend some concepts of porphyry copper distribution based on prior geologic knowledge of major structural trends.</p>			
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Preface

- (a) Objective: The objective of the project is to see if ERTS imagery can be used for detecting regional tectonic structures that in turn are associated with mineralization.
- (b) Scope of Work: Transparency overlays to a mosaic of ERTS imagery display not only a composite lineation study but eight individual systems. These eight systems were analyzed in relation to known porphyry copper locations. Comparison between natural color and IR color underflight photography to individual ERTS channels 5 and 7 for detection of hydrothermal alteration zones noticeable on the aerial photography met with limited success.
- (c) Conclusion: The Arizona ERTS imagery is very advantageous in interpreting not only regional structural trends, but also patterns of fault and fracture systems especially in regards to the role they play in intersecting at locations of porphyry copper deposits.
- (d) Summary of recommendations: It is recommended that the published tectonic maps of arid regions, i.e., Arizona, be updated by incorporating interpretations performed on ERTS imagery.

Introduction

The purpose of this report is to discuss the scientific progress to date on our contract in evaluation of the mineral exploration potential of ERTS-1 imagery. The scope of work has been to the phase of a detailed interpretation of a mosaic of MSS, Channel 7, imagery. These prints are positive black-and-white enlargements to a scale of 1:1,000,000 from the 70mm negatives. The mosaic covers both the test site and also an extensive area surrounding the area of interest which has better enabled us to detect the trend of regional lineations that are discontinuous in some locations.

Geologic Structural Trends

The interpretations were performed on transparent overlays to the ERTS imagery that in turn can be compared against other maps of the same scale, i.e., aeromagnetics and published structural maps. The ERTS imagery displays three general structural trends that have been further subdivided into eight systems. A descriptive discussion of the transparency overlays and these trends is as follows:

- (1) System "A" N40E to N50E, is remarkably straight and apparently quite continuous, but made up of very short segments, at least as visible to the interpreter in the MSS imagery. Schmitt* correlates this direction with older Precambrian-through-Cretaceous activity. It appears to be considerably offset by other possibly younger systems of EW and NW trends.

* Harrison A. Schmitt, "The Porphyry Copper Deposits in Their Regional Setting," GEOLOGY OF THE PORPHYRY COPPER DEPOSITS, Southwestern North America, Titley and Hicks, The University of Arizona Press, 1968.

- (2) System "B" N50W, similar overall to system "A" but is weaker in continuity and persistence and is possibly offset.

- (3) System "C" N35W, curves into and out of system "B" faults.

This system includes much (young) Basin-and-Range high-angle faulting and at the same time it projects roughly toward the Las Vegas-Walker Lane systems to the NW. Very little offset exists and possibly it is the youngest of these three systems.

On one transparency the N-S and E-W structures have more complex distribution, and the (arbitrary) assignment of identifications to the "systems" is speculated to be as follows:

- (4) System "D" N65E to N75E, are very short individual segments, much offset and yet remarkably persistent across the study area and spaced around 20 miles apart.

- (5) System "E" N-E, plus or minus about ten degrees, is rather sinuous and complex, and in some areas dominant and in others nearly obliterated. It appears to include many elements of both the Wasatch-Jerome and Front Range Orogens as described by Schmitt, but there is the strong suggestion also that another possibly older subparallel N-S "system" has been somehow incorporated. This system ("E") appears to be involved in the regional distribution of the copper porphyries.

- (6) System "F" N25W average, curves toward the south. This trend plots very closely on or parallel with Schmitt's Wasatch-Jerome axis, and has previously been used to "explain" the Miami-Inspiration, Ray, San Manuel and other porphyry deposits.

It has been offset to some degree by roughly E-W lateral movements, possibly in both directions, certainly including left-lateral.

- (7) System "G" N75W average, curves toward the south. This is the Texas zone or Texas Orogen, described by Schmitt and others, and plots very closely in relation to Schmitt's maps. However, it is apparent that there are possibly older associated subparallel trends (system "H") which it has "utilized", and that at least some of these are offset right-laterally. The gross correlation of systems "G" with known porphyry locations is remarkable.

- (8) System "H" close to E-W. This system has strikes averaging within a few degrees of E-W, but its segments are both highly offset by other systems and markedly curved at their ends, the radii of curvature being on the order of 100 miles. The subjective, speculative inference is that system H may represent part of the "oldest" rosette, including probably systems A, B, and E. One might speculate even further, that the "older" N-S segments of System E and the "old" system H form a nearly orthogonal set of (perhaps) Precambrian age.

In any case, at least eight identifiable (by strike) fault/facture systems are present in the study area and there are also other, local or anomalous individual structural trends (many correlatable to present Basin-and-Range topography and its associated drainage net). This is considered to be a remarkable revelation of geologic data, both by comparison

to existing geologic maps and in relation to other regional structural studies made by modern, airborne remote sensing techniques.

Program for Next Reporting Interval

The work we have planned between now and the next reporting period will be as follows:

- (1) Analysis of 9" x 9" color composites for hydrothermal alteration zones detected on the underflight aerial color and IR color photography.
- (2) Further comparisons between ERTS imagery and Apollo, Gemini space photos for determination of spatial resolution in relation to detection of minor lineations.

Conclusions

The Arizona ERTS imagery is very advantageous in interpreting not only regional structural trends, but also patterns of fault and fracture systems especially in regards to the role they play in intersecting at locations of porphyry copper deposits.

Recommendations

It is recommended that the published tectonic maps of arid regions, i.e., Arizona, be updated by incorporating interpretations performed on ERTS imagery.